

# TMR + VHT FOR SAFETY-CRITICAL SYSTEMS AND AUTOMATED VEHICLES

Angle Sensing with Full Diagnostics and Redundancy



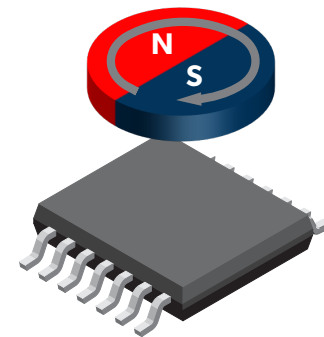
Designed for performance and safety, the TMR + VHT solutions from Allegro are a step toward enabling Level 3 and higher levels of driving automation.

Our TMR + VHT family of angle sensors are the first in the industry to combine tunneling magnetoresistance (TMR) technology and vertical Hall technology (VHT). The TMR + VHT combination enhances performance with fast response time and high levels of safety and diagnostic coverage in a single package with heterogeneous signal redundancy.

Designed for driving automation and advanced driver assistance system (ADAS) applications that require high performance, our TMR + VHT sensors deliver magnetic detection on primary (TMR) and secondary (VHT) elements, which are processed by two independent angle sensing channels:

- The TMR channel provides high precision for motor control.
- The VHT channel enables safety checks, including low-field and missing-magnet detection.

The TMR + VHT devices are 360-degree angle sensor ICs that provide contactless high-resolution angular position data based on magnetic sensing technology. The channels provide redundant angle sensing and measure magnetic flux density in the x-y plane, parallel to the branded face of the device. The data from each channel are processed in parallel to compute an angle measurement based on the x-y vector input.



**TMR + VHT Sensor IC:  
 14-Pin TSSOP (Suffix LE) Package**

## Features

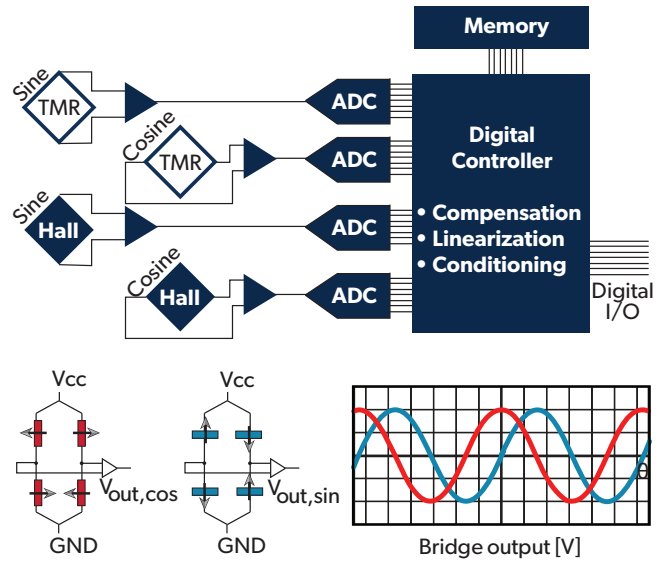
- Primary TMR channel capable of 14-bit noise-free resolution
- Secondary VHT channel capable of 10-bit noise-free resolution
- Wide operating voltage (3.7 to 18 V) to enable direct connection to vehicle battery
- Linearization to reduce error from misalignment between the sensor and target magnet
- ASIL D compliant when used in conjunction with appropriate system-level control
- AEC-Q100, Grade 1
- On-chip turns counter and low-power mode for monitoring and maintenance of the turns count of the magnet in a key-off condition (A33115 only)

# Precision TMR Angle Sensing with Integrated Diagnostics

## TMR + VHT Sensor IC

The resulting angle data on the primary and secondary channels pass through independent analog signal conditioning, high-speed sampling analog-to-digital converters, and digital filtering and signal processing. These signals are combined and are available in multiple output options, including SPI, PWM, and either motor commutation (U, V, W) or encoder (A, B, I).

Integrated on-chip EEPROM technology supports a large number of read/write cycles for flexible end-of-the-line programming of calibration parameters. Additionally, eight distinct EEPROM-selectable combinations of the TMR and VHT channels can be joined with the ABI/UVW, PWM, and SPI outputs, and either channel can be read via SPI.



## Applications

### Automotive

- Electronic power steering
  - Steer by wire
- Electronic braking
  - Brake by wire
  - Electromechanical braking

### Industrial

- Industrial motors
- Robotics

## Selection Guide

Part Number	Sensor Technology	Description	Packaging
<a href="https://www.allegromicro.com/en/products/sense/linear-and-angular-position/angular-position-sensor-ics/a33110">A33110</a> <sup>[1]</sup>	TMR + VHT	360° angle sensor ICs that provide contactless high-resolution angular position data	14-pin TSSOP (Suffix LE)
<a href="https://www.allegromicro.com/en/products/sense/linear-and-angular-position/angular-position-sensor-ics/a33115">A33115</a> <sup>[2]</sup>	TMR + VHT	360° angle sensor ICs that provide contactless high-resolution angular position data with low-power mode turns-count monitoring and maintenance of the magnet in a key-off condition	14-pin TSSOP (Suffix LE)

<sup>[1]</sup> <https://www.allegromicro.com/en/products/sense/linear-and-angular-position/angular-position-sensor-ics/a33110>

<sup>[2]</sup> <https://www.allegromicro.com/en/products/sense/linear-and-angular-position/angular-position-sensor-ics/a33115>

To learn more about the Allegro family of products and to explore available design resources, visit [allegromicro.com](https://www.allegromicro.com).

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